

WHAT IS CLAIMED IS:

1. A multi-layer optical circuit comprising:
  - a plurality of optical circuit layers, each optical circuit layer positioned on a corresponding substrate;
  - 5 an optical fiber extending between at least two optical circuit layers and forming a portion of the at least two optical circuit layers.
2. The optical circuit of claim 1, wherein the substrates of the optical circuit layers are stacked to form the multi-layer optical circuit.
3. The optical circuit of claim 1, wherein the optical fiber extends continuously  
10 between at least two optical circuit layers.
4. The optical circuit of claim 1, wherein the substrates are flexible.
5. The optical circuit of claim 4, wherein at least one substrate is disposed on a printed circuit board.
6. The optical circuit of claim 1, wherein at least two substrates are connected to  
15 each other by a substrate portion extending between the two substrates.
7. An optical circuit comprising:
  - a first optical circuit layer disposed on a first substrate portion;
  - a second optical circuit layer disposed on a second substrate portion;
  - and
  - 20 an optical fiber of the first and second optical circuit layers extending continuously between the first and second optical circuit layers.
8. The optical circuit of claim 7, wherein the first and second substrate portions are disposed in a stacked orientation.

9. The optical circuit of claim 7, further comprising a third optical circuit disposed on a third substrate portion, wherein an optical fiber of the third optical circuit layer extends continuously between the third optical circuit layer and at least one of the first and second optical circuit layers.
- 5 10. The optical circuit of claim 7, wherein the first and second substrate portions are physically separate from each other.
11. The optical circuit of claim 7, wherein the first and second substrate portions are connected to each other by a substrate connection portion extending between the first and second substrate portions.
- 10 12. The optical circuit of claim 7, wherein the first and second substrate portions are separated from each other by an open window portion, and wherein the optical fiber extends over the window portion.
13. A method of forming a multi-layer optical circuit comprising:  
    patterning optical fibers to create a first layer of the optical circuit on a  
15 first substrate;  
    patterning optical fibers to create a second layer of the optical circuit on a second substrate, wherein the first and second substrates are separated from each other, and wherein at least one optical fiber is integral with and extends between the first layer and the second layer; and  
20 positioning the first and second substrates in a layered arrangement.
14. The method of claim 13, wherein positioning the first and second substrates in a layered manner comprises laying the second substrate on the first substrate.
15. The method of claim 13, wherein positioning the first and second substrates in a layered manner comprises rotating the second substrate relative to the first substrate.

16. The method of claim 13, wherein positioning the first and second substrates in a layered manner comprises twisting the second substrate relative to the first substrate.

17. The method of claim 13, further comprising:

5 positioning the first and second substrates in a coplanar orientation prior to patterning optical fibers to create a first layer of the optical circuit on the first substrate and patterning optical fibers to create a second layer of the optical circuit on the second substrate.

18. The method of claim 13, wherein positioning the first and second substrates in a layered arrangement occurs subsequent to patterning optical fibers to create a first  
10 layer of the optical circuit on a first substrate and patterning optical fibers to create a second layer of the optical circuit on a second substrate.

19. The method of claim 17, wherein positioning the first and second substrates in a layered arrangement comprises positioning the first and second substrates in a bi-planar orientation subsequent to patterning optical fibers to create a first layer of the  
15 optical circuit on the first substrate and patterning optical fibers to create a second layer of the optical circuit on the second substrate.

20. The method of claim 13, further comprising:

20 patterning optical fibers to create a third layer of the optical circuit on a third substrate, and wherein at least one optical fiber extends from at least one of the first layer of the optical circuit on the first substrate and the second layer of the optical circuit on the second substrate; and

positioning the first, second and third substrates in a layered arrangement.

21. The method of claim 13, wherein the patterning further comprises securing the  
25 optical fibers to the first and second substrates adjacent ends of the optical fibers.

22. The method of claim 13, wherein the first substrate and the second substrate are connected to each other.
23. The method of claim 22, wherein the first and second substrates are connected to each other by a substrate strip extending between the first and second substrates.
- 5 24. A method of forming a three-dimensional optical circuit comprising:  
arranging a plurality of optical fibers to create an optical circuit;  
securing ends of the plurality of optical fibers so as to leave the optical  
fibers unattached along their lengths; and  
positioning sets of the secured ends of the plurality of optical fibers at  
10 predetermined positions within a three-dimensional volume.
25. The method of claim 24, wherein securing ends of the optical fibers comprises securing the sets of the secured ends at a pitch suitable for termination with a connector.
26. The method of claim 24, further comprising terminating the ends of the  
15 plurality of optical fibers with connectors.
27. A method of forming a multi-layer optical circuit comprising:  
patterning first and second optical circuits on first and second  
substrates, wherein said first and second circuits include a common optical  
fiber; and  
20 positioning said first and second substrates in a stacked arrangement,  
wherein said positioning comprises a substrate manipulation selected from the  
group consisting of bending, folding, twisting and rotating at least one of the  
first and second substrates relative to the other.
28. The method of claim 27, wherein the patterning further comprises patterning  
25 said first and second optical circuits in a common plane.

29. The method of claim 27, wherein the patterning further comprises patterning a third optical circuit on a third substrate, wherein said third circuit includes a common optical fiber with one of said first and second optical circuits.

30. The method of claim 29, wherein the positioning further comprises a substrate manipulation selected from the group consisting of bending, folding, twisting and rotating the third substrate relative to at least one of the first and second substrates.

31. The method of claim 27, further comprising embedding at least one of said first and second circuits onto its respective substrate.

32. The method of claim 27, wherein said first and second circuits include a plurality of common optical fibers, and further comprising orienting the common optical fibers in a plane parallel to at least one of the substrates.

33. The method of claim 27, wherein said first and second circuits include a plurality of common optical fibers, and further comprising orienting the common optical fibers in a plane perpendicular to at least one of the substrates.

34. The method of claim 27, further comprising providing a crease region between the substrates.

35. The method of claim 34, further comprising orienting the common optical fiber in said crease region.

36. The method of claim 27, further comprising providing a window region between the substrates.

37. The method of claim 36, further comprising orienting the common optical fiber in said window region.

38. An optical circuit comprising:  
a first circuit layer;  
a second circuit layer stacked on said first circuit layer; and  
an interlayer bus extending between said first and second circuit layers  
5 and forming an integral portion of said first and second circuit layers.
39. The optical circuit of claim 38, wherein the interlayer bus comprises at least one continuous optical fiber.
40. The optical circuit of claim 38, further comprising a substrate disposed between said first and second circuit layers, wherein said interlayer bus extends  
10 beyond a perimeter of said substrate.